

**CLAIM SET AS AMENDED:**

1. (Currently Amended) A control system for controlling a plant having an operating characteristic which describes the translation of a plant input to a plant output, wherein the plant operating characteristic has a linear component and a non-linear component, the control system comprising:

a feedback control function; and

a feed-forward control function,

wherein a demand signal is simultaneously applied to respective inputs of the feedback and feed-forward control functions, and respective outputs of the feedback and feed-forward control functions are summed together to generate the plant input, the feed-forward control function having a first component which is a function of a model of the linear component of the plant characteristic, and a second component which is an adaptive function to compensate for the non-linear component of the plant characteristic, the adaptive function being substantially modeled on the non-linear component of the plant characteristic and having adaptive laws which vary parameters of the adaptive function with time such that the adaptive function approaches the non-linear component of the plant characteristic, and

~~wherein the plant is a permanent magnet linear motor (PMLM) wherein the feedback control function is a Proportional/Integral/Derivative (PID) controller.~~

2. (Previously Presented) The control system of claim 1 wherein the non-linear component of the plant characteristic is of the form:

$$u_{ripple} = A(x)\sin(\omega x + \phi) = A_1(x)\sin(\omega x) + A_2(x)\cos(\omega x),$$

where  $x$  is the plant variable,

and where the adaptive function has the form:

$$u_{AFC} = a_1(x(t))\sin(\omega x) + a_2(x(t))\cos(\omega x),$$

where

$$a_1(x(t)) = -ge \sin(\omega x),$$

$$a_2(x(t)) = -ge \sin(\omega x),$$

$e$  is an error signal given by:

$$e = (x_d - x),$$

$g$  is an adaptation gain and is greater than 0,  $x_d$  is the desired function of the plant variable and  $\omega$  is related to 1/period of the non-linear component of the plant characteristic, such that the adaptive feed-forward control function continuously adjusts the parameters  $a_1$  &  $a_2$  in response to the error signal  $e$ .

3. (Currently Amended) The system of claim 2, wherein the plant is a permanent magnet linear motor (PMLM), the plant variable  $x$  represents an instantaneous position of a translator of the linear motor, the desired function of the plant variable  $x_d$  represents the desired trajectory of the translator and the PMLM has a magnetic structure having a pole pitch  $x_p$ , such that  $\omega = 2\pi / x_p$ .

4. (Currently Amended) The system of claim 3 wherein the adaptation gain has a value which is greater than zero and less than or equal to one.

5. (Original) The system of claim 4 wherein the adaptation gain has a value which is less than 0.6.

6. (Original) The system of claim 5 wherein the adaptation gain has a value which is greater than or equal to 0.2.

7. (Original) The system of claim 6 wherein the adaptation gain is equal to 0.2.

8. (Canceled)

**REMARKS**

Applicants thank the Examiner for the thorough consideration given the present application. Claims 1-7 are pending. Claim 8 is canceled without prejudice to or disclaimer of the subject matter contained herein. Claims 1, 3 and 4 are amended. Claim 1 is independent. The Examiner is respectfully requested to reconsider the rejections in view of the amendments and remarks set forth herein.

**Reasons for Entry of Amendments**

At the outset, it is respectfully requested that this Amendment be entered into the Official File in view of the fact that the amendments to the claims automatically place the application in condition for allowance.

In the alternative, if the Examiner does not agree that this application is in condition for allowance, it is respectfully requested that this Amendment be entered for the purpose of appeal. This Amendment reduces the issues on appeal by canceling allowable claim 8 and incorporating the limitations thereof into independent claim 1. This Amendment was not presented at an earlier date in view of the fact that Applicants did not fully appreciate the Examiner's position until the Final Office Action was reviewed.

**Allowable Subject Matter**

The Examiner states that claims 2-8 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

In response, the allowable subject matter of objected-to claim 8 is incorporated into independent claim 1. Therefore, independent claim 1, and the claims which depend directly or indirectly therefrom, should be in condition for allowance. Claim 8 is now canceled.

**Claim for Priority**

The Examiner has recognized Applicants' claim for foreign priority. A certified copy of the priority document will be filed in due course.

**Rejection under 35 U.S.C. §103(a)**

Claim 1 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Stuntz et al. (U.S. 6,039,028) in view of "Linear Motor Motion Control Using a Learning Feedforward Controller". This rejection is respectfully traversed.

As noted, the allowable subject matter of claim 8 is incorporated into claim 1. Therefore, claim 1, and the claims depending therefrom, are in condition for allowance. Claims 8 is canceled. Accordingly, reconsideration and withdrawal of the rejection under 35 U.S.C. §103(a) is respectfully requested.

**CONCLUSION**

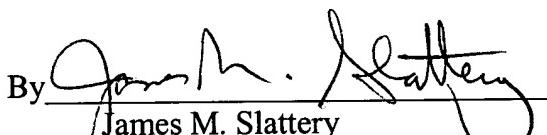
All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. It is believed that a full and complete response has been made to the outstanding Office Action, and that the present application is in condition for allowance.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, he is invited to telephone Carl T. Thomsen (Reg. No. 50,786) at (703) 205-8000.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§1.16 or 1.17, particularly extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By   
James M. Slattery  
Reg. No. 28,380

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Attachments  
JMS:CTT:jls

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P. O. Box 747  
Falls Church, VA 22040-0747  
(703) 205-8000